BUD-11A (1-07)
Page 1

U. S. DEPARTMENT OF ENERGY
FIELD WORK PROPOSAL

1. WORK PROPOSAL NO.:	2. REVISION NO.:	3. DATE PREPARED:	3a. CONTRACTOR NO.:
2450.1		03-15-07	53210

4. WORK PROPOSAL TITLE:
ILC Detector R&D

5. BUDGET & REPORTING CODE:	6. WORK PROPOSAL TERM: Begin: End:	7. IS THIS WORK PACKAGE INCLUDED IN THE INST. PLAN?	7a. PRINCIPAL INVESTIGATORS:
KA-15-03-02		☒ YES ☐ NO	Repond, J.

8. HEADQUARTERS/OPERATIONS OFC PROGRAM MANAGER:	11. HEADQUARTERS ORGANIZATION:	14. DOE ORG. CODE:
Staffin, R. No. 301-903-3624	High Energy Physics	SC
9. DOE FIELD ORGANIZATION WORK PROPOSAL REVIEWER:	12. DOE FIELD ORGANIZATION: Chicago	15. DOE ORG. CODE: CH
10. CONTRACTOR WORK PROPOSAL MANAGER: Weerts, H.J. No. 630-252-8831	13. CONTRACTOR NAME: UChicago Argonne, LLC	16. CODE: 12

17. IS THIS PROPOSAL TO DO WORK THAT INCLUDES A SECURITY INTEREST? ☐ YES ☒ NO

18. WORK PROPOSAL DESCRIPTION (Approach, anticipated benefit in 200 words or less):

The goal of this project is to study of how to achieve the required jet energy resolution at the ILC. Conventional calorimetric approaches will not achieve the required 30%/sqrt(E). We have adopted the Particle Flow approach, which requires a sophisticated algorithm to obtain the resolution. We are developing this algorithm, which is one of the directions of this R&D. The other component is the development of a new finely segmented hadron calorimeter. The ultimate R&D goal is to construct a prototype section of a highly segmented hadron calorimeter for the ILC. The section includes 40 layers, each with an area of 1 m^2, of Resistive Plate Chambers, interleaved with 20 mm steel plates as absorber. The section will undergo a detailed test program at the MTBF test beam at Fermilab, planned for 2008/9. This effort is considered an important part of the overall program of the CALICE collaboration. The main purpose of this project is a) to validate our technological approach to finely granulated hadron calorimetry using Resistive Plate Chambers, b) to validate our concept of the electronic readout system with a highly multiplexed front-end, c) to perform precision measurements of hadronic showers with unprecedented spatial resolution, d) to validate the Monte Carlo simulation of hadronic showers, and e) to compare its performance with the performance of the scintillator-based tile calorimeter section currently being built by the CALICE collaboration.

19. CONTRACTOR WORK PROPOSAL MANAGER:		20. OPERATIONS OFFICE REVIEW OFFICIAL:	
H. Weerts	03-15-07		03-15-07
SIGNATURE	DATE	SIGNATURE	DATE

21. DETAIL ATTACHMENTS: (See specific attachments.)

☐ a. Facility requirements	☒ e. Approach	☐ i. NEPA requirements	☐ m. ES&H considerations
☐ b. Publications	☒ f. Technical progress	☒ j. Milestones	☐ n. Human/Animal Subjects
☒ c. Purpose (mandatory)	☒ g. Future accomplishments	☐ k. Deliverables	☐ o. Security requirements
☐ d. Background	☒ h. Relationships to other projects	☐ l. Performance Measures/Expectations	☒ p. Other (specify)

WORK PROPOSAL REQUIREMENTS FOR OPERATING/EQUIPMENT
OBLIGATIONS AND COST

CONTRACTOR NAME	WORK PROPOSAL NO.	REVISION NO.	CONTRACTOR NO.	DATE PREPARED
UChicago Argonne, LLC	2450.1		53210	01/31/2007

21. STAFFING (in staff years)	PRIOR YEARS	FY2007	FY2008 ESTIMATE	FY2009 REQUEST	FY2009 AUTHORIZED	FY2010	FY2011	TOTAL TO COMPLETE
a. Scientific		3.0	4.0	3.0		0.0	0.0	
b. Other Direct		0.0	0.0	0.0		0.0	0.0	
c. Technical Services*		0.0	0.0	0.0		0.0	0.0	
d. Total Direct		3.0	4.0	3.0		0.0	0.0	
23. OBLIGATIONS AND COSTS (in thousands)								
a. Total Obligations		1114	1227	773		0	0	
b. Total Costs		1056	1218	840		0	0	
24. EQUIPMENT (in thousands)								
a. Equipment Obligations		0	0	0		0	0	
b. Equipment Costs		0	0	0		0	0	

25. MILESTONE SCHEDULE (Tasks)	FY2009 DOLLARS		PROPOSED SCHEDULE	AUTHORIZED SCHEDULE
	PROPOSED	AUTHORIZED		

26. REPORTING REQUIREMENTS

* Technical services staffing includes ANL support divisions' scientific effort.

BUD-10 (1-07)

CONTRACTOR NAME	CONTRACTOR CODE	CONTRACTOR NUMBER	
UChicago Argonne, LLC	CH	53210	
WORK PACKAGE NUMBER	WORK PROPOSAL NUMBER	DATE PREPARED	REVISION NUMBER
	2450.1	03-15-07	

21. DETAIL ATTACHMENTS: (See specific attachments.)

☐ a. Facility requirements	☐ e. Approach	☐ i. NEPA requirements	☐ m. ES&H considerations
☐ b. Publications	☐ f. Technical progress	☐ j. Milestones	☐ n. Human/Animal Subjects
☒ c. Purpose (mandatory)	☐ g. Future accomplishments	☐ k. Deliverables	☐ o. Security requirements
☐ d. Background	☐ h. Relationships to other projects	☐ l. Performance Measures/Expectations	☐ p. Other (specify)

a) FY 2006-2007 Accomplishments: Efforts in detector R&D have concentrated on the development of a hadron calorimeter for an ILC detector. Current designs of ILC detectors are driven by the application of Particle Flow Algorithms (PFAs) to the reconstruction of hadronic jets. A jet energy resolution of $30\%/\sqrt{E}$ has been defined as the design goal. PFAs require that the calorimeter be read out with extremely fine segmentation and be located inside the superconducting coil. The intermediate goal of the Argonne group is to build and test a 1 m^3 prototype section of a hadron calorimeter equipped with Resistive Plate Chambers (RPCs). In the past year the group achieved the following accomplishments: a) Two complete PFAs have been developed and tested within the SiD detector concept. The achieved resolutions are approaching the goal of $30\%/\sqrt{E}$. b) RPCs have been tested in the Fermilab test beam. The results were shown to be consistent with measurements obtained previously with cosmic rays. c) The front-end ASIC for the readout of RPCs has been prototyped. Prototype ASICs were thoroughly tested at Argonne. The results were very satisfactory. d) The design of the entire chain of the electronic readout system for the prototype section has been completed, prototyping of the individual subsystems has begun and we are assembling a vertical slice of the complete readout chain. e) Significant contributions to the development of the SiD detector, including proposals for the mechanical structure of the calorimeter, were made.

b) FY 2008 Plans: The development of PFAs will continue, with the aim of achieving the required jet energy resolution in the simulation. The algorithms will be used to optimize the SiD detector design, balancing performance versus cost. An RPC based test calorimeter with 400k readout channels will be constructed. The cell size will be of order 1cm^2, providing an unprecedented spatial resolution. The prototype calorimeter will be tested in the Fermilab test beam with protons, pions, and muons in the energy range of 1 to 120 GeV.
The work on the SiD detector design study will continue. It is expected that the design will have been optimized at this time and that efforts on a full mechanical design, including structural analysis, will start. First prototype components will be produced for SiD.

c) FY 2009 Plans: The prototype section will be thoroughly tested in the Fermilab test beam. The data will be analyzed and compared to predictions of various hadronic shower simulations. Work on optimizing the design of RPCs for use in the hadron calorimeter of an ILC detector and of developing a highly multiplexed readout system will commence. Further optimization of the SiD design and prototyping and testing of subcomponents will take place.